Vol. 109 No. 7 October 2, 1948

The American FERTILIZER

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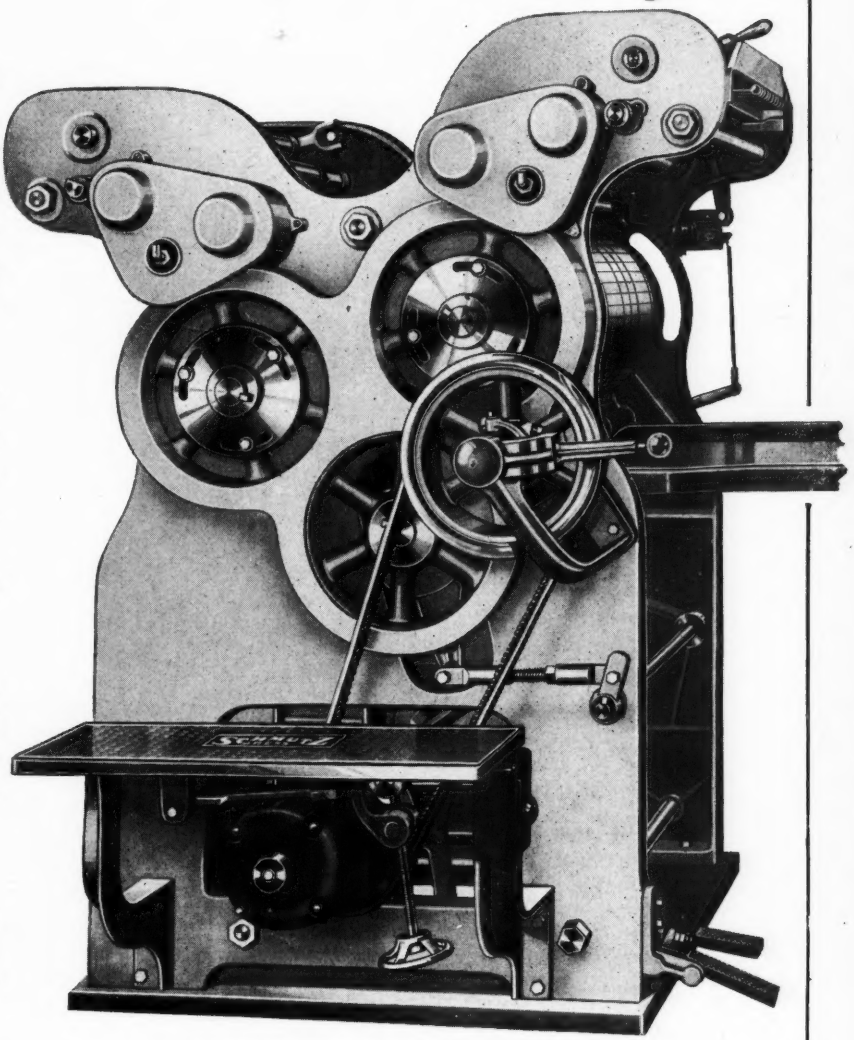

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The American FERTILIZER

Vol. 109 OCTOBER 2, 1948 No. 7

Food, Famine, Fertilizers and Peace*

Some Random Observation

By Vincent Sauchelli

Director of Agricultural Research, The Davison Chemical Corporation, Baltimore, Md.

The subject I have chosen is indeed a broad one. But don't be alarmed. I shall not go into details. My purpose will be to show first that the rapidly increasing world population coupled with the present inadequate supplies of food and feed is a potential cause of war and then point out how modern scientific agricultural practices and particularly the use of commercial fertilizer can mitigate, if not entirely remove, this potential menace of war.

World Population Increase

To stop war, stop having babies! That startling statement appeared as a headline in a recent scientific journal. That idea was old even with the ancient Greeks. It won't work. The general theme of the article was that, due to food supplies, peace may be insured sooner by cutting down on the birth rate than by reducing armaments.

The experts tell us that the human race at present is on a reproduction binge, that during the past decade or so, despite the slaughter of War, the world's population increased by about 200,000,000. Some parts of the world are growing enormously, while other parts are barely holding their own. The stork seems busiest in countries with the smallest food crops. The world does not have enough food to feed everybody, let alone provide each with an adequate diet.

The birth problem varies from country to country. The United States has a birth rate of 17 per thousand; Russia, 37; China, about 33. The death rate is higher in the Asiatic countries. By 1960 the United States is expected to have an increase of 21,000,000, Russia 29,000,000, China about 40,000,000.

How are these new mouths to be fed?

The United States has an average of about three acres of land under cultivation for every person and produces about 10,000 calories per person. Russia produces an average of 4,600 calories. Asiatic countries produce an average of about 2,800 calories. The leading South American countries produce an average of about 7,000 calories per person, but this includes their meat production which is chiefly on the range and not on cultivated land.

One sure way to increase the food supply, some contend, is to cultivate more land. That is not the best answer, as will be shown later. Food should be produced where it is to be eaten, because of transportation difficulties and because most of it is perishable. It has been estimated that the more advanced nations are producing 10 times more food per person than the poorer countries. The need in less favored nations is for more education in agronomy, more and better farm machinery, more fundamental research in animal and plant breeding, a greater production and use of chemical fertilizers, a more general practice of soil and water conservation and a more effective control of agricultural

* Paper presented before the 3rd Annual Convention of the Plantfood Producers of Ontario, Canada, September 27–30, 1948.

diseases and pests. This need will be discussed in more detail later on.

You in Canada and we in the United States are among the few in the world who can get a well balanced diet. Nutritionists tell us that only 27 per cent of our diet is in cereals—the food less fortunate people generally have to fill up with. We can balance the cereals with animal foods such as eggs, meat, and milk and with fruits and vegetables, giving us at least 3,000 calories per day. Russians eat less than the necessary 3,000 calories daily. They have to depend on cereals for about two-thirds of their calories.

China's millions get an average of about 2,200 calories with about three-fourths of the diet furnished by rice. India's people are much in the same position as China's. Most of the countries of South America, except Argentina and Uruguay, are underfed, having a daily intake of less than 3,000 calories of which about one-third is in cereals.

Race Against Hunger

The world is in a race against hunger. This probably has always been the case, but the present situation is relatively more acute than ever.

Hunger knows no laws, is an old saying. A hungry nation, in its desperation, does not hesitate to invade the territory of its more fortunate neighbors in order to seize sources of food, even at the cost of war. History records many such invasions. Many economists keep insisting that hunger is the root cause of war. That being so, is there nothing our proud civilization can do to prevent it? What could our scientific agriculture do if given a chance? Does the scientific approach merely provide a stopgap solution until merciful death through horrible starvation kills off the surplus, famished millions?

Black indeed would be the outlook if we did not have bright, hopeful prospects of some remedial action. "The future is a world limited chiefly by ourselves." Modern agricultural science holds out the greatest hope. The Food and Agricultural Organization of the United Nations, fully appreciating the crucial importance of an adequate food supply to prevent famine and possible war, is doing something about it. One of its first measures is an educational campaign among the more backward people of poorer nations, designed to improve crop production practices and to use chemical fertilizers effectively to increase yields and nutritional quality. More direct and immediate help has been the shipment of foodstuffs overseas from American and Canadian farms.

Increasing Food Per Acre

In a recent speech accepting the 1948 medal from the Industrial Research Institute, Gaines Slayter of Ohio told how scientific farming practices can increase the amount of food per acre. Using his home county in Ohio as an example, he contrasted its present capacity to feed 70,000 people with the 176 people that were supported on the same area in a hunter's economy. Moreover, he pointed out that instead of the 70,000 people now supported, the same area could support an estimated 175,000 people if all the farmers in the county could be made to farm as productively as the 10 best farmers in the area.

Crop Yields, 1771–1945

One often hears that our soils produced more in "the good old days" and that crops were bigger when they were fertilized with animal and vegetable manures alone. Many cultists, even today, advertise the supreme virtues of animal manures and composts. What are the facts? The written record is always more reliable than the hearsay. Recently Dr. W. G. Ogg, distinguished Director of the Rothamsted Experimental Station in England, released some interesting data which compare crop yields during more than a century and a half. His *pre-fertilizer* crop yields were taken from Arthur Young's book published in 1771, titled *Tour through the East of England*, and the Board of Agriculture survey figures for 1793–1815. Similar official figures were taken for 1885–94 as a guide to yields about *50 years after* the beginning of the chemical fertilizer industry. These yields were compared with Ministry of Agriculture averages for 1936–45 and also with yields recorded at the Rothamsted farm during the same recent period. This farm is not to be confused with the specific Rothamsted experiment plots. This farm uses twice the average British application of fertilizer nitrogen per acre, but not more than the British national average of phosphates and potash.

Dr. Ogg pointed out that many farmers in Britain, especially the smaller ones, are not using as much fertilizer as they should. That observation is just as pertinent in Canada and the United States.

The five crops quoted by Dr. Ogg are tabulated in Table I.

TABLE I

	Pre-fertilizer		Post-fertilizer		Rothamsted Farm
	1771	1793–1815	1885–1894	1936–1945	1936–1945
Crop					
Wheat (bu)	24	21	29.5	34.5	50
Oats (bu)	38	35.5	40.5	47	73
Barley (bu)	32	32.25	33	38	55
Beans (bu)	33	25.75	25.75	26.75	36
Mangolds (tons)		..	17.5	19	21.75

Of course, it is not fair to credit the increases in yields exclusively to application of commercial fertilizers and Dr. Ogg did not suggest that. Other modern factors which have contributed are the control of diseases and pests, advances in plant breeding and in farm mechanization. Nevertheless, the factor of chemical fertilizers is most significant, for without it the other factors could not produce and sustain the large increases in yields.

The most significant thing about these data is not in their direct comparison. The figures for 1771 derived from Young's book are greater than the official figures for 1793–1815. Young's estimates contained many errors but, as Dr. Ogg suggested, they are the best we have for that period. What I believe these data emphasize is that in Great Britain as in Canada and the United States we are not making the fullest use of fertilizers in the production of food and feed crops. The data for the Rothamsted farm in the table show what can be expected from an increased application of nitrogen alone. Similar increases have been realized in North Carolina and throughout our Corn Belt by means of relatively higher applications of nitrogen on the corn crop. However, if the nitrogen is increased, one must make sure that the phosphoric acid and potash and perhaps some of the micronutrients are present in adequate amounts. Nutrition of each crop must be maintained in balance for maximum results. One realizes best what deficiencies of native soil nutrients may be present when he begins to crop the soil intensively.

These are only some of many examples that could be cited to illustrate the same point, namely, that modern agricultural science has given us the means for greatly increasing food production per acre. It is in this connection that the fertilizer industry can make its greatest contribution. In what follows I shall try to develop some thoughts on this particular phase of my subject.

The Farm a Chemical Factory

Farming is essentially a vast *chemical factory* which converts raw plant nutrients into foods for humans and feeds for livestock; but how many farmers realize this? Farming has been and remains in most countries an art not a science or business. In all countries, including yours and mine, many farmers still buy almanacs in order to be able to plant according to certain phases of the moon. The crops of this important chemical factory obtain their supplies from the air and the earth. From the air come carbon dioxide, oxygen and solar energy in unlimited quantities. From the earth come water and a large number of nutrients, chief among which are calcium, nitrogen, phosphorus, potassium, and magnesium. The nutrients in the soil are not inexhaustible; to maintain a balance, they should be replenished as they are removed.

It takes more than nitrogen, phosphate, potash and water to grow commercial foods, feeds and fibres. In recent years scientific research has revealed the importance also of the micronutrients, proper soil reaction, soil microbes and some specific organic substances. Weather, of course, is always a dominant factor. We have to leave a great deal to Mother Nature. What makes a plant grow is still one of those baffling unknowns that awaits a solution. Tennyson put this thought in beautiful verse:

"Flower in the crannied wall;
I pluck you out of the crannies,
I hold you here, root and all, in my hand,
Little flower—but if I could understand
What you are, root and all, all in all
I should know what God and man is."

From the moment the young seedling weans away from its mother seed and starts on its own to get food, it follows a process whose intricacies continue to puzzle our ablest investigators. New tools and new techniques must be developed to unlock these secrets of Nature. Perhaps the radioisotopic tracer technique may prove to be that new tool.

Business Principles in Farming

Farming must become more of a business and less of a social institution if it is to carry out its function in our economy. In any chemical factory the production department controls the chemical and physical specifications of its raw materials down to the minutest detail. It also knows its unit costs and strives at all times to lower them. Failure to do this may prove costly and even ruinous. But in the greatest chemical factory of all, the farm, so many growers seem to leave a great deal to chance. To be sure, effort is made to furnish plant nutrients and some thought is given to water and soil management factors. The farmer places the crop plant in an environment chosen for it and *hopes* all the necessary growth factors are present: water, food, soil organisms, correct soil texture, and so on. The plant is left to itself to make the best of it, regardless of excesses or deficiencies. Can he do more? I believe he can. The business farmer of today knows how, or is fast learning how, to

lower unit costs of production by growing more on fewer acres, how to carefully select better producing cows, hogs and hens, how to grow more feeds of higher digestible nutrient content, thereby reducing his feed bill on concentrates, how to make a more efficient use of land, labor and labor-saving methods, how to use chemical fertilizers for reducing costs, increasing yields and profits, and maintaining a high level of soil fertility, and how to conserve water resources. That is a big order, I admit. That it is being carried out by many progressive business farmers is common knowledge.

New Technologies

The great changes in modern agriculture have been changes in degree rather than in kind. The range of crops grown throughout the world is pretty much what it has been for centuries. Technologies, however, are new. Today agriculture can benefit from so many new technologies created by the engineering and biochemical sciences for lowering the unit cost of production. The use of such technologies has freed nations like yours and mine from the necessity of using men and women in the back-breaking burdens of running an irrigation wheel, plowing with oxen or living under inhuman dictatorships.

When Sir William Crookes gloomily predicted a wheat shortage by 1931 he reckoned without the scientific plant and animal breeder and chemical engineer—products of the present century. Out of his calculations, too, were the implement manufacturer, the tractor and bull-dozer, and the modern food-preserving technologies. Since his day we have seen an enormous increase in nitrogenous fertilizers produced synthetically. Strangely enough, this new abundance of nitrogenous fertilizers has not greatly influenced wheat or other grain crops. It is only quite recently that the farmer in the United States has become aware of the possibilities of nitrogen for increasing and maintaining the yields of hybrid corn. Two pounds of nitrogen, it is estimated, are needed to produce one bushel of corn.

The average corn yield in the United States is about 34 bushels per acre. In some regions it is less; in others more. If American farmers made full use of the know-how of the new technologies, they could grow the present 3.5 billion bushels on about 60 million acres instead of the 90 million acres now used and at the same time make more profit and conserve more soil. Many farmers are producing 100 bushels per acre. About a third (40 per cent) of the acreage in the United States devoted to corn yields about an average of 16 bushels per acre. The cost of production with such a low yield is about $1.00 or more per bushel. When corn is selling at $1.00 per bushel, he has no profit; at $2.00 per bushel, that farmer may be making a little profit but he is no large factor in the market for industrial goods. As Dr. George Scarseth put it, in such communities the farmer competes with the mule for the corn—and that corn does not show up on the table, often enough, as bacon and eggs, or milk, or steaks.

High Yield Factors

The average putput on American farms in relation to total acreage and to output per worker has been at record levels during the past decade. It is expected by the U. S. D. A. that no sizeable reductions will occur in the foreseable future. Many marginal farmers will be eliminated. Six major factors will tend to keep production levels on the active farms as follows:

1. The benefits from use of higher rates of fertilization are being appreciated more and more.
2. Improved seed, especially hybrids, are giving higher yields.
3. Better means for fighting weeds, diseases and pests.
4. Better farm machinery.
5. Increasing opportunities for chemurgic utilization of farm crops and residues.
6. Most farmers realize that high production of the individual producer is the key to high consumption of the individual consumer.

The Plant Breeder

The plant breeder and the fertilizer industry today are able to give the farmer practical means with which to raise 100 bushels or more of corn to the acre on any corn land in America in a normal year at a cost ranging from 30 cents to 70 cents per bushel, giving him profits of $30.00 to $70.00 per acre when corn is worth $1.00 per bushel.

The scientific plant breeder, working in close alliance with the commercial fertilizer industry and the farm implement industry, has given technologies to agriculture which conceivably could eliminate the curse of hunger from the world. Consider the extraordinary extension of the zone in which wheat can be grown today and the steadily increasing actual or potential yields of the wheat belts of the world. The limits to such extensions have scarcely been reached.

(Continued on page 20)

Maine Potato Fertilizer Tests

The sixty-fourth annual report of the Maine Agricultural Experiment Station, Orono, Maine, covering the year ending June 30, 1948, contains brief reports of a number of potato fertilizer experiments being conducted by the station. These cover tests with the three major fertilizer elements, as well as some of the minor elements and with the new radioactive phosphorus isotopes. The summaries of these tests, together with the research workers who were in charge, are given below.

Potash Source Experiments

G. I. Terman, Arthur Hawkins, and S. C. Junkins

The potash sources used in this study were muriate or chloride (KCl), and sulphate (K_2SO_4). In 5 tests with the Katahdin variety, the differences in yield of potatoes for the 2 sources were small and not significant. In one test with the Green Mountain variety, however, sulphate produced a significant increase in yield of 34 bushels over the chloride source of potash. Thus there appears to be a varietal difference as to the response to the chloride and sulphate sources.

As to quality of the tubers, the sulphate source of potash produced a consistently higher content of starch, as indicated by specific gravity determinations, than did chloride. This difference averaged one per cent in starch content, or an increase from 13.5 to 14.5 per cent. Chemical tests for soluble nutrients in fresh rachis portions of the green potato vines showed that the plants fertilized with muriate had a considerably higher chloride content, and a somewhat lower content of nitrogen, magnesium, and dry matter. There appears to be a fairly close inverse relationship between the content of chloride in the plant and the starch content of the tubers.

Radioactive Phosphorus Fertilizer Tests

Arthur Hawkins

Radioactive isotopes offer a means of determining what proportion of an element absorbed by plants is taken from the applied fertilizer as compared to that taken from residues in the soil. The location and movement of a radioactive material in the plant also can be traced by the use of special instruments or photographic methods.

Radioactive phosphorus at the rates of 40 and 120 pounds of P_2O_5 per acre was added to the fertilizer applied to potatoes at 3 locations in Aroostook County. Samples of the potato plants, taken at early bud stage, full bloom, and 5 weeks later, were analyzed for total and radioactive phosphorus.

Results from the experiment indicate that the potatoes take a larger amount of phosphorus from the fertilizer as the amount of phosphorus in the fertilizer is increased. On a soil low in readily soluble phosphorus, 26.7 per cent of the total phosphorus in the plants at the final sampling date had been absorbed from the fertilizer with the smaller application of P_2O_5, as compared to 51.5 per cent from the larger application. The corresponding figures for soils with a medium phosphorus content were 13 per cent for the smaller application versus 26 per cent for the larger application. On the soils medium in phosphorus content, only 9 per cent of the phosphorus applied at the 120 pound rate was used by the potatoes. A comparable figure for potatoes grown on soil low in phosphorus was 25 per cent of the 120 pounds of P_2O_5 applied.

At earlier sampling dates potatoes had obtained a higher proportion of their phosphorus from the fertilizer than at the later date. This indicates that potatoes may be largely dependent upon the applied fertilizer early in the season. As the season progresses, the crop is able to obtain an increasingly large proportion of its phosphorus needs from the soil.

Phosphorus Placement Tests

Arthur Hawkins, G. L. Terman and J. C. Junkins

Placement tests were conducted on potatoes at 4 locations near Presque Isle. The regular placement of the phosphorus as triple superphosphate in row side bands with the nitrogen and potash fertilizer was compared with placing only the phosphate nearer the seed pieces in bands about 4 inches wide. Since greenhouse tests showed that freshly cut seed was injured when planted in direct contact with superphosphate, about one-fourth inch of soil was placed either on top of the band of phosphate before the seed was

(Continued on page 2.)

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Principal Articles in This Issue

Two New Plants For Lion's Chemical Division

According to announcement by T. M. Martin, president, Lion Oil Company has signed contracts for two new construction projects at its chemical plant near El Dorado, Arkansas. The company will construct a sulphuric acid plant and an ammonium sulphate plant—the two projects estimated to cost approximately two million dollars. Actual construction of both of these plants is scheduled to begin within the next thirty days. These projects are in addition to the $3,500,000 expansion to the anhydrous ammonia facilities already under way.

The larger of the two new plants will be the sulphuric acid plant which will be of the "contact" type. This plant, when burning 100 tons per day of Texas Bright Sulphur or equivalent will produce 300 tons per day of sulphuric acid. The equipment will consist of a furnace, reactor towers, air blowers, acid pumps, storage tanks, a pit for melting sulphur and storage facilities for the sulphur and for 2,000 tons of sulphuric acid. Vanadium catalyst will be used in the operation.

The sulphuric acid plant is estimated to cost $1,250,000 and the Chemical Construction Corporation of New York is under contract on a cost-plus-fixed-fee basis for the design, engineering and procurement of all materials. Chemical Construction will also be the contractor for the actual construction of the sulphuric acid plant.

The ammonium sulphate plant will consume 288 tons per day of sulphuric acid and 100 tons per day of ammonia to produce a total of 380 tons per day of commercial grade ammonium sulphate. The principal equipment will be contactors, centrifuges, driers, conveyors, and bulk storage for 4,000 tons of ammonium sulphate. The complete sulphate plant is estimated to cost approximately $750,000 and the Chemical Construction Corporation is under contract to engineer, procure materials and supervise the construction of this plant. The contract for the actual construction of the sulphate plant has been awarded to the Blaw-Knox Construction Company of Pittsburgh, Pa.

Designing for the new plants is reported already to be seventy-five per cent complete on each project. Procurement is over fifty per cent complete and actual construction of foundations is scheduled to begin in November, 1948. Tentative completion dates for both projects have been set for September 1, 1949.

August Sulphate of Ammonia

Production of by-product sulphate of ammonia during August totaled 72,047 tons, an increase of 2.5 per cent over July, according to the figures of the U. S. Bureau of Mines. In addition, another 2,303 tons was manufactured from purchased synthetic ammonia. Production for the first eight months of 1948 came to 544,990 tons, about 20,000 tons higher than the same portion of 1947. Shipments during August were slightly higher than during July so that stocks on hand at producing plants were still less than two weeks' production totals.

	Sulphate of Ammonia Tons	Ammonia Liquor Tons NH
Production		
August, 1948	72,047	2,082
July, 1948	70,272	2,107
August, 1947	69,199	2,103
January-August, 1948	544,990	16,299
January-August, 1947	524,818	17,176
Shipments		
August, 1948	73,123	1,891
July, 1948	62,887	1,511
August, 1947	69,936	1,899
Stock on hand		
August 31, 1948	30,152	537
July 31, 1948	32,885	497
August 31, 1947	25,340	632

Hoffman Elected Vice-President of Link-Belt Company

Mr. Ralph M. Hoffman, president of Link-Belt Company, Pacific Division, San Francisco, was elected a vice-president of the parent Link-Belt Company, at the quarterly meeting of the Board of Directors, held recently in Chicago. Mr. Hoffman joined the predecessor of the Pacific Coast Company—Meese & Gottfried Company—in 1913.

During his long career, Mr. Hoffman has served in many important executive capacities in both the parent and subsidiary companies. He continues president of Ling-Belt Company, Pacific Division, the position he has held since 1943.

Bemis Cotton Mill Builds Clinic for Employees

A modern medical clinic for the use of employees and their families has been built by the Bemis Cotton Mill in Bemis, Tennessee. The building and some equipment are owned by Bemis Bro. Bag Co. which is making office and laboratory space available to doctors and dentists for a nominal rental fee.

Housed in a $25,000 brick building, the clinic's facilities include physio-therapy and X-ray equipment, dental operating rooms and laboratory, medical laboratory and fireproof vault, as well as rooms for reception, consultation, treatment and recovery.

This latest addition to the Bemis community is now partially in operation and will be fully staffed as soon as necessary arrangements are completed.

New Hough Payloader Shovel Announced

The Frank G. Hough Co., 704 Sunnyside Avenue, Libertyville, Illinois, has announced the addition of a new Payloader to their line of complete tractor-shovel units. This new unit is known as the Model HM Payloader and features a revolutionary four-wheel drive and a power-boosted steering mechanism. This is the first time that the four-wheel drive principle has ever been applied to this type of equipment.

The Model HM, which was first displayed at the 1948 Road Show, is the biggest of the Payloader line, having a bucket capacity of 1½ cu. yds. and a static loading capacity of 6,000 lbs. Its 76 hp. engine, four-wheel drive and large 14.00–24.00 road builder tires on all four wheels provide the power, traction and flotation necessary for successful off-road operation—to a degree never before possible in wheeled tractor-shovel design.

Power steering on the rear wheels makes this machine easy to steer, and short wheel base and fully-reversing transmission with four speeds in either direction give it unusual maneuverability.

Both the bucket-raising-and-lowering and bucket-dumping-and-closing is accomplished by double-acting hydraulic rams, fingertip controlled. The bucket booms are so designed that an automatic powerful digging action is given to the bucket independent of the forward motion of the tractor. Also an automatic quick tip-back of the bucket is provided as it is raised so that heaped loads can be retained without spillage and can be carried low for good machine balance and full operator visibility.

Because the operator's seat is located well forward and there are no super-structures, the operator has fullest visibility at all times and the height of the machine is low so that it can travel and work in low overhead locations.

Pneumatic tires and top travel speeds of 16 miles an hour also enable the Model

HM to travel and work on any paved surface without damaging it and to get to jobs fast under its own power. This new Payloader is designed to dig, load trucks and other vehicles, to spread, level, strip, skim, carry and bulldoze, to charge hoppers and conveyors, plow and load snow, to lift and push. Bulldozer blade, crane hook and snow plow attachments will be available to further increase its multi-purpose usefulness. Literature and further details, including the name of nearest distributor, can be obtained by writing the manufacturer.

Nevins Joins Mathieson Ammonia Department

S. L. Nevins has joined Mathieson Chemical Corporation as general manager of the company's newly formed ammonia department, according to an announcement by Thomas S. Nichols, president and chairman of the board.

Mr. Nevins is credited with a number of developments in the manufacture of fertilizer chemicals, served on the sulphuric acid and superphosphate advisory committees for the War Production Board and the Office of Price Administration during World War II, and since then has been serving on the Industry Nitrogen Advisory Committee to the Department of Commerce. He will have headquarters in Mathieson's New York offices and at its Lake Charles, La., ammonia plant.

A native of St. Louis, Mo., Mr. Nevins attended the Missouri School of Mines from which he was graduated with a B.S. in chemical engineering in 1920. The following year was spent with Monsanto Chemical Co. From 1921 until he joined Mathieson he was with the Southern Acid & Sulphur Co., Inc., where he pioneered a number of new developments, including new processes for production of superphosphate and the recovery of sulphur from waste gases. Mr. Nevins was also responsible for the development of the large plant at Houston for production of ammophos and sulphate of ammonia. He is a member of the American Chemical Society, Chemists Club and Chemical Market Research Association.

OBITUARY

William Charles Mast

William Charles Mast, senior construction engineer of the Chemical Construction Corporation, died in New York City, September 17, 1948 at the age of 62. Mr. Mast was an employee of this organization since its founding in Charlotte, North Carolina in 1914 and was the inventor of the drum-type sulphuric acid concentrator.

Dr. W. F. Hand

Dr. W. F. Hand, long time Professor of Chemistry of Mississippi State College and State Chemist of Mississippi, died quietly at his home just off the College campus, September 25, 1948, after a long illness. He was 74 years of age.

Born at Shubuta, Mississippi, with the exception of the time spent at Columbia University where he worked out a doctorate under Marston T. Bogert, his whole life was spent in Mississippi. He was past President of the Association of Official Agricultural Chemists, Association of American Feed Control Officials, as well as many Southern and local associations. In 1941 he had received the Herty Award.

In 1945 he voluntarily went on an emeritus status as Dean of the School of Science, Professor of Chemistry and State Chemist. At the time of his death he was active Vice-President of Mississippi State College and served on the Academic Council.

FERTILIZER MATERIALS MARKET

NEW YORK

Little Change in Tight Position of Chemical Nitrogen Market. No Price Change Noted. Organic Material in Better Demand by Feed Trade at Prices Above Fertilizer Level. Superphosphate Adequate. Some German Sulphate of Potash Received

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, September 29, 1948.

Sulphate of Ammonia

Heavy demand was taxing producers capacity to make shipments. No price changes were noted.

Nitrate of Soda

Regular arrivals continued at various ports and importers were shipping the material out upon arrival to regular customers.

Ammonium Nitrate

A heavy demand continued for this material from various sections and no price changes were noted. It was hoped there might be some additional material available before the end of the current fertilizer season.

Nitrogen Solutions

A shortage exists in most sections of this material and producers in a good many cases are behind on shipments. No immediate relief is looked for.

Nitrogenous Tankage

One producer has withdrawn his quotations but other material is available at regular contract prices. Shipments are being made as the material is produced

Castor Pomace

This market remained firm, due to lack of offerings and sold up position of the producers. Buyers are taking the material whenever available.

Organics

Packing house by-products such as tankage and blood are firm in price at around $7.50 to $7.75 per unit of ammonia ($9.12 to $9.42 per unit N) f.o.b. Eastern shipping points, with very little material offered. The feed trade entered the market a short time ago and took most of the available supplies. No South American is being offered on account of present high asking prices in South America. While prompt soybean meal was commanding a good price for shipment over the next 30 days, future positions were offered considerably lower in price as the result of offerings from the new crop. Cottonseed meal was also offered lower for shipment late this year. Most buyers were not buying ahead.

Fish Meal

With the present fishing season practically over, sales were being made to the feed trade from stocks on hand and 60 per cent ground menhaden was held at around $130 pr ton, f.o.b. Baltimore. Demand from the feed trade continued good.

Bone Meal

The demand from the feed and fertilizer trade continued heavy and several producers reported they were sold up for the next month or so. Raw bonemeal was in good demand.

Superphosphate

Shipmates are going forward on regular contracts and very little additional trading is reported. Triple superphosphate remains scarce.

Potash

A large cargo of sulphate of potash from Germany was reported to have arrived at Wilmington, North Carolina, with another cargo on the way to another port. As far as could be learned there is no more of this material available.

PHILADELPHIA

Material Position Still Tight. Farmers Slow in Placing Orders. Superphosphate Ample. Foreign Potash Landed

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, September 27, 1948.

The chemical nitrogen position continues definitely tight and organics have also strengthened. There is a feeling that farmers are slow in placing their orders, but this is only natural under present conditions, and normally this would also be rather early. Labor difficulties are reported in some sections of the West.

Sulphate of Ammonia.—This remains in greater demand than can possibly be supplied and resale offerings are extremely limited. There seems to be no relief in sight for the coming season.

Nitrate of Soda.—The supply continues inadequate and sales are made only for prompt shipment from any stocks that are available.

Ammonium Nitrate.—This is still in greater demand than can be supplied and some contract deliveries are behind schedule. Advance in first hands prices is reported of $2.50 to $5.00 per ton, depending on the producer.

Castor Pomace.—Production has been cut and it is all under contract. No offerings are reported.

Blood, Tankage, Bone.—Higher feeding demand and restricted production have developed a rather firm market and these materials are now out of reach of the average ($8.82 per unit N) fertilizer mixer. Blood is quoted at $7.25 per unit of ammonia in New York, and $7.50 ($9.12 per unit N) Chicago; tankage $7.25 ($8.82 per unit N) New York and $7.75 ($9.42 per unit N) Chicago. Hoof meal is rather firm at $7.00 ($8.51 per unit N), Chicago basis. Bone meal for fertilizer use is scarce.

Fish Scrap.—The fishing season is now about over and no offerings of scrap are reported. Menhaden meal is in fair demand by the feeding trade and is quoted at $125.00 per ton for 60 per cent protein grade, with $130.00 for 65 per cent.

Phosphate Rock.—Inability of some acidulators to take delivery, and increased production, make the supply position easier, but high operating costs keep prices firm.

Superphosphate.—Material is in ample supply but deliveries have slackened due to limited storage space at buyers' plants. No price change is reported.

Potash.—The supply is still less than requirements, although it is expected that domestic production will be increased about 10 per cent in the coming season. Something over 6,000 tons of sulphate of potash came in last week from the American Zone in Germany and was discharged at Southern ports. Another lot is due shortly.

CHICAGO

Increased Supply of Vegetable Meals Cutting in on Protein Market. Trading in Animal Organics Slackness

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, September 27, 1948.

The potential influx of soybean and other vegetable meals is creating some concern in the protein markets and the recent strength in the value of these products has tapered off somewhat in anticipation of the possibility of values declining due to this substantial increase in available supplies.

Distributors and consumers are unwilling to carry large stocks and trading during the

past couple of weeks has been more or less on the basis of replacement or immediate turnover. Consequently the volume of business has declined sharply.

Meat scraps are generally held around $100.00 per ton but there has been some selling at slightly under this figure. Digester tankage is still held at around $110.00 per ton but this price would also probably be shaded on volume business. Dry rendered unground tankage is quoted at $1.65 to $1.70 per unit of protein, f.o.b. midwest shipping point. Wet rendered tankage, unground, $7.75 to $8.25 ($9.42 to $10.02 per unit N), and dried blood $7.50 to $8.00 ($9.12 to $9.72 per unit N), depending upon quality and location. Steamed bone meal, 65 per cent, is $65.00 to $67.00 per ton and raw bone meal $65.00 per ton.

CHARLESTON

Nitrogen Shortage Hampers Mixing and Crowds Storage of Oother Materials. Import of Potash Reported. Organics Tighter

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, September 27, 1948.

Mineral nitrogen continues short in all forms. Affecting the production and consumption of superphosphate considerably. Boxcar shortage threatens to hamper movement of potash, but approximately 12,000 tons of imported sulphate of potash are reported arrived and arriving during October.

Organics.—Interest has increased recently in dried blood and tankage but this interest is primarily from the feed trade. Domestic nitrogenous continues to be quoted at $3.50 to 94.00 per unit of ammonia, ($4.25 to $4.86 per unit N), f.o.b. works, depending on the location of the production point. Foreign and South American organics remain at price levels which are too high to be competitive with domestic organics.

Castor Pomace.—Sales have been made recently at $27.50 to $30.00 per ton, f.o.b. eastern production points. Movement is primarily against current contracts.

Dried Ground Blood.—The New York market is around $7.75 to $8.00 per unit of ammonia ($9.42 to $9.72 per unit N) with the Chicago market rather bare of offerings. The Chicago market is nominally $8.00 to $8.25 per unit of ammonia ($9.72 to $10.02 per unit N).

Fish Scrap and Fish Meal.—Demand has improved from the feed trade and menhaden meal is quoted at $125.00 for 60 per cent protein grade in the Baltimore area. Sixty-five per cent grade is around $130.00.

Hoof Meal.—The market is established at around $7.00 per unit of ammonia ($8.51 per unit N) in bags in the Chicago area.

Nitrate of Soda.—No change has been noted in the tight market conditions. No announcement has yet been reported regarding contracts for the new season on imported material. The price of domestic nitrate of soda has been advanced $3.00 per ton, effective October 1.

Potash.—Shortage of boxcars is beginning to concern shippers and receivers of potash. When the grain crop has been moved, this shortage is expected to ease. It is reported that 7,000 tons of imported sulphate of potash were received partly at Wilmington, N. C. and the remainder being unloaded at Jacksonville, Fla., and Mobile, Ala. Another 5,000 tons is expected to arrive at Baltimore and Norfolk late in October. The price of this imported material is reported at $66.88 per ton with adjustment as to analysis. The market, however, continues tight on all types of potash.

Phosphate Rock.—Normal market conditions prevail, due to expansion in production

SAID THE MOUNTAINEER

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and relaxation of the heavy demand on the part of consumers.

Superphosphate.—Stocks are adequate to meet demand and some producers are in a crowded storage position due to inability to get sufficient nitrogen for basing purposes.

Ammonium Nitrate.—The market is quoted at $52.50 per ton to $56.50 per ton in bags, carload lots, f.o.b. the works, depending on the location of the producer. Demand continues strong and supply inadequate to meet the call.

Sulphate of Ammonia.—The market continues tight and any resale quantities that are available are bringing prices, in some cases, considerably over the producer's price schedule. Demand is far in excess of supply.

Bone Meal.—Demand for this type of organic is nominal, and the price is around $60.00 to $62.00 per ton for 4½ and 45 fertilizer grade at Chicago.

Effect of Weed Killers on Soil Structure Studied

Chemicals, oil sprays and flaming for killing weeds have already proved their success in tests at several Experiment Stations and farmers are making increasing use of these new methods on several crops. The long-term effect of these innovations on the soil itself, however, has never been studied to any extent. A new study, aimed at finding the answer to these questions, has been initiated this year at the Connecticut Agricultural Experiment Station.

Under the direction of Dr. C. L. W. Swanson, chief soil scientist, the experimenters are comparing these new methods with the long-used cultivation way of controlling weeds. Their theory is that the effect upon soil structure and, hence, upon the productivity and vigor of plants may differ with the different methods.

Ideally, to produce best plant growth, soil should be well-aerated and should contain a large amount of organic matter. The Connecticut soils men know that several years of intensive cultivation with heavy machines packs soil. On some light soils, on the other hand, continuous cultivation stirs up the soil too much, and results in loss of organic matter. The chief purpose of the current experiments is to see if newer methods, which disturb the soils less, are more beneficial.

Results of the first year's trials indicate that some cultivation is necessary under certain weather conditions. The early 1948 season was marked by abnormally high rainfall. In May almost twice as much rain fell as is normal for that month, while in April and June, also, rain was heavier than usual. In contrast, July and August were abnormally dry. The result was that soil in the test plots of corn, uncultivated and treated with 2,4-D or flame throwers for weed control, were first packed by the heavy rains and then baked to a hard crust by the dry, hot weather that followed. Soil on cultivated plots, in contrast, was loose and well-aerated. Consequently, corn on the cultivated plots was more vigorous, had better growth and color and, from visual evidence, will produce considerably higher yields.

Dr. Swanson believes, however, that over a period of years with varied weather conditions, the experiment will show very different results. Soil structure samples taken this summer from potato land in continuous cultivation for 10 years showed that soil in the area traveled by the tractor was 17 per cent heavier than that in the potato row itself. This shows that soil continuously cultivated by machinery does tend to pack and become more dense, resulting in poor soil structure.

The Connecticut Station experiment will be continued for several years and results at the end of the period should clear up this point conclusively. At the present, it looks as if cultivation cannot be discarded completely by any means, but that eventually less machinery will be run over the land due to new weed control methods and the result will be better soil structure.

Materials Handling Show to Be Held in January

The third national Materials Handling Show will be held at Convention Hall, Philadelphia, January 10–14, 1949. The exposition is devoted to various systems of handling materials in production and shipment.

This year the show will be jointly sponsored by the management and materials handling divisions of the American Society of Mechanical Engineers and the Material Handling Institute. The A.S.M.E. groups will conduct a five-day Conference on Materials Handling concurrently with the exposition. A Materials Handling Theatre will exhibit late films on handling subjects.

Among the many types of equipment to be exhibited will be hand trucks, lift trucks, conveyors, hoists, monorails, portable elevators, stacking units, cranes, tractors, trailers, fork trucks, skids and pallets, and their respective accessories.

"Low cost movement of materials and more extensive use of existing facilities has become, in recent years, one of management's key problems," said S. W. Gibb, general sales manager, Philadelphia division, Yale and Towne Manufacturing Co., and president, Material Handling Institute. "Efficiency in handling is the key to lowered operating costs. Equally urgent is the utilization of the full height and width of plant facilities for lowered overhead costs.

"One-quarter of every dollar of industry's payroll is spent for handling. In some industries, the cost runs up to as much as fifty per cent. Yet handling adds nothing to a product except cost. Unused cubic footage in plants represents another loss.

"Here is an economic waste of billions of dollars annually which efficient handling techniques can eliminate. Labor's productivity depends on being supplied with the best in machines. To the consumer, lowered costs for handling mean a halt in the rising cost of living. To industry, lowered operating costs plus greater use of existing capital assets, mean greater profit."

FOOD, FAMINE, FERTLIZERS AND PEACE

(*Continued from page 10*)

Present day farming practices in the wheat belts of Canada and the United States surely are not representative of what the intelligence of man can devise to raise the acre yield to its maximum. The aim of the wheat grower is to keep his costs down rather than produce the maximum ears of grain per square rod of soil. In Canada the introduction of the Marquis wheat in the western provinces raised the yield at least five bushels per acre. In Australia the wheat farmer of the Wimmers district has enormously improved his production practices, particularly by the use of new farm machinery, to his great profit advantage. Where before he got 7 bushels per acre, he now gets 40 bushels per acre. These improvements—hybrid corn in the United States, Marquis wheat in Canada and mechanization of farming in Australia—illustrate what remarkable benefits can be achieved by the abundant use of fertilizers, heavy seed rates, the use of improved varieties capable of producing higher yields when properly fertilized, and the proper use of new powered farm machinery.

Nutritive Value

Generally speaking, the emphasis on crop production is in terms of dollars and profits. That is all right, but I believe *more emphasis* should be given to the nutritive value of the

crop. I know you will agree with me. In the United States, as I prevously pointed out, our corn crop of over 3.5 billion bushels comes from about 90,000,000 acres, of which about 33,000,000 acres produce on an average about twelve to twenty bushels per acre. This means not only that production costs on such poor land are excessively high, but that those impoverished soils are producing millions of bushels of corn of relatively low nutritive value. Starved soils sustain hungry crops. Consequently, millions of people and stock eating the produce of such starved soils will suffer from nutritional deficiencies. Nutritional anemias and other diseases caused by nutrient deficiencies are now recognized by science in all countries. Poor soils make poor people poorer.

For the years immediately ahead, scientists with the help of enlightened farmers and an alert fertilizer industry have a great opportunity to emphasize the importance of nutritional quality in crops. Research in the field of nutrition and health as related to the soil is now in its infancy. The farmer today grows an enormous amount of water, an immense amount of quite useless fibre, and a great deal of carrier or scaffolding on which to carry his nutritional crop. One job for the plant breeder is to reduce this vast waste of vital energy. The ideal goal of output per acre should be total digestible nutrients and not so many tons or bushels per acre of mere carrier material or stomach-distending roughage. Animal breeders have succeeded in producing hogs that have an almost boneless ham, cows that are merely a food pouch and udder, and hens that are a food pouch and enlarged ovary. Plant breeders can be expected to increase nutritional quality. Don't you see that when the farming world has the means, the knowledge and the incentive for reaching that goal, one of the most powerful weapons will have been forged for driving out the scourge of famine from the world and at the same time eliminating one of the basic causes of war?

These considerations of nutritive efficiency are increasingly important to all of us. The problem is how to make more consumers and producers aware of them. The standards of quality which prevail in the market today have grown up without the benefit of much serious research as to nutritive value. Trace requirements seem to dominate. Eye appeal or other subtle psychological consideration that will make the product sell is what counts. Practices in fertilizer use show a similar tendency. The agronomist and farmer seem to be chiefly concerned with increasing gross yields per acre. Fortunately, in most instances, when yield is substantially increased, quality is also increased, especially if sufficient plant nutrients are provided.

The point I am stressing and hope you will remember is that all of us—fertilizer men, agronomists, farmers consumers, retailers—all of us should forget cheapness and think more and more on ultimate nutritive value. Cheapness makes one concentrate too much on gross yields alone per acre. What is important is gross yields *plus* maximum nutritional value. The amount of land available for crop production is not necessarily the limiting factor to food production on this earth. Fewer acres and more crops with a substantially higher nutritive content should be the goal. The two are compatible. Let us forget today's standards and economics in thinking of crop production for the future. Evolution will bring about needful changes, if we start doing something about them soon enough. When the incentive becomes strong enough to bring about the possibilities for full production, then nutritive yield per acre rather than gross tons or bushels per acre will, I trust, be the dominant consideration, because it then will be the controlling economic factor.

Agrobiologists like Dr. O. W. Willcox in the United States have been vainly trying for years to change the scientific approach to crop production. They show that a better appreciation of the quantitative dynamics of crop nutrition could revolutionize present concepts of crop production. They claim that by applying the principles of agrobiology, farmers with the help of plant breeders can increase gross yields and nutritive content far beyond any of the high records of today. The prospect is a fascinating and hopeful one for the future.

(*Continued on page 24*)

Research

What are we going to do with all the agricultural products we shall produce? The answer is to be found in *farm chemurgy*—the industrial utilization of surplus crops and farm wastes. The farm is going to be called upon more and more to supply raw materials of chemical industry. Example: corn for manufacture of starch now requires 140,000,000 bushels per year, equivalent to production of about 10,000 acres per day. Corn cobs are being used to produce furfural used in nylon manufacture. Soybean oil is being used in the preparation of paints, adhesives, and so on. Many other farm products could be mentioned. Farm chemurgy provides a large supplementary market for many basic products of the farm and, by taking up slack, tends to balance demand with supply. Here in Canada, chemurgy is playing an ever increasing role in your economy. Your National Chemurgic Committee of the Canadian Chamber of Commerce has already a splendid record of achievement. For years you have had to import over 50 per cent of your needs of total fats and oils, exclusive of butter. As I understand it, you have imported as high as 250,000,000 pounds. You are now determined to increase your domestic supplies of vegetable oils. Linseed oil, rape seed, soy bean and even sunflower seed oils are being produced in huge ton lots. Who has not heard of the highly modern plant in Toronto belonging to Victory Mills Ltd. as an example of team-work among farming, manufacturing and science. Ontario is one of the leading provinces in the production of soybeans, accounting for over 1,000,000 bushels or about 95 per cent of Canada's total production. The research and development on the recovery of starch and gluten from wheat reported by your National Research Council by which over 90 per cent of the starch is recovered and an almost complete recovery of the gluten—this is an indication of what may be expected in modern farm chemurgy.

Let me risk a platitude: industry cannot grow without research. Whatever tends to reduce costs and create better products will increase demand. This truism applies just as much to the fertilizer industry as to other industries. Despite the substantial growth made by the fertilizer industry during the past half century, I think it may be said it has lagged behind other members of the great modern chemical industry in utilizing the research tool to advance its own welfare. It has depended in our countries, at least, too much upon government for the solution of its problems. I intend no criticism of the government laboratories and agricultural experiment stations. They have done a splendid job and more power to them. It does seem to me, nevertheless, that a great deal more can be accomplished by agriculture in general and the fertilizer business in particular, by a more active participation in research projects, by utilizing their own technical facilities, and by direct cooperation with government research agencies through fellowships and direct grants-in-aid. One example of this is the joint research project with radioactive isotopes in the United States, sponsored by the fertilizer industry and government agencies to advance their common welfare. Another example more familiar to you is the grant-in-aid to the Ontario Agricultural College generously given by the Eastern Canada Fertilizer Manufacturers' Association. Such partnerships in research are mutually beneficial and are entirely in the public interest.

Conclusion

You are engaged in a basic business, vital to the common weal. You earn and deserve success. As I see it, ours is a business rendering an essential service to agriculture, the mother of all industries; to the soil, the mother of all life; and indirectly through better nutrition to the health and vigor of man and his beasts. The farmer in his field, the chemist in his laboratory, the mechanic in his shop, the banker at his desk—each renders a service contribution to the general welfare, each is an essentaial part of a mighty machine. For anyone to fail or shirk his job is to hold up the progress of the whole. The record shows that during the strenuous war period and since then, the fertilizer industry in your country and mine has bent all its energies and talents to serve the economic well-being of our fellowmen.

MAINE POTATO FERTILIZER TESTS

(*Continued from page 11*)

planted, or on the planted seed pieces before the band was applied.

At 3 locations having soils low to medium in readily soluble phosphorus, yields of Katahdin potatoes were appreciably lower when the 80 pounds P_2O_5 per acre was applied with the seed rather than applied in side bands. At the fourth location on a soil high in phosphorus, the 2 methods of application produced the same yield. In 3 out of 4 tests, application of 80 pounds P_2O_5 with the seed and an additional 80 pounds in side bands resulted in slight but not significant increases in yield over applying 160 pounds P_2O_5 in side bands. In general, the application of all of the phosphate in side bands in the usual manner was slightly better than applying part or all of it with the seed.

Liming and Rate of Phosphorus Tests

Arthur Hawkins, G. L. Terman, and J. C. Junkins

These tests were conducted at 2 locations near Presque Isle for the purpose of determining the possible effect of liming acid soils on the efficiency of the phosphorus applied in the fertilizer. Ground limestone was broadcast on the 2 soils, having *pH* values of 4.3 and 5.0 at the rate of 3000 pounds per acre and harrowed in prior to planting potatoes. Phosphorus was applied at the rates of 0, 60, 120, 180, and 240 pounds P_2O_5 per acre on different plots, all of which received nitrogen and potash equivalent to 2000 pounds of 6–0–10. Liming did not increase the efficiency of the phosphorus applied in the fertilizer, nor were potato yields higher on the limed plots than where lime was not applied. No potato scab was found in the limed plots.

At one location on a soil low in phosphorus, yield increases were obtained for all rates of P_2O_5 compared, although increases for the higher rates were not significant. At the other location on a soil medium in phosphorus, the yields increased only up to 180 pounds P_2O_5.

Nitrogen Rate Experiments

G. L. Terman, Arthur Hawkins, S. C. Junkins, and Michael Goven

Six field experiments were conducted comparing different rates of nitrogen for potatoes. The fertilizer mixtures were applied at the rate of 2000 pounds per acre with the nitrogen rates consisting of 90 pounds (4½–9–9), 120 pounds (6–9–9) and 150 pounds (7½–9–9). All the fertilizer was applied in row side-bands at planting in the usual manner.

Yields of potatoes were the same for the 3 nitrogen rates for 2 tests with the Katahdin variety following clover the previous year. In 3 tests with the Katahdin variety following potatoes the previous 2 or 3 years, however, significant increases in yield resulted from the 120 pound nitrogen rate over 90 pounds. Further increases were obtained from 150 pounds of nitrogen over 120 pounds, although these increases were not significant. In one test with the Green Mountain variety following clover, a decrease in yield resulted from both the 120 and 150 pound rates, as compared to 90 pounds. These tests indicate a varietal difference of potatoes as to their response to nitrogen fertilization, as well as a difference due to the cropping practice.

In tests previous to 1947, little or no increase in yields was obtained for more than 80 to 100 pounds of nitrogen for potatoes following clover or 120 pounds following potatoes the previous year. With better control of insects and diseases, the tubers continue to develop for a longer time and more nitrogen may be used.

Response of Potatoes to Zinc

G. L. Terman and Arthur Hawkins

Fertilizer containing none or only trace amounts of zinc was compared in 4 experiments with fertilizer containing 20 pounds of zinc sulphate per acre. In 2 of the tests potatoes yielded the same, whether fertilized with zinc sulphate or not. In the other 2 tests zinc sulphate increased the yield by 12 bushels per acre in both tests. In one of these tests, zinc increased yields an average of 32 bushels on the plots cropped every year to potatoes, 11 bushels on plots where potatoes are grown in alternate years with crimson clover and only 2 bushels on plots in a similar rotation with millet. These results indicate that zinc may be more deficient in some soils cropped every year or frequently to potatoes than where a rotation is practiced and adequate amounts of organic matter are returned to the soil. The yield responses to zinc in the fertilizer may possibly explain some of the higher yields obtained with dithane and other fungicides containing zinc sulphate, as compared to others containing no zinc.

Potato Soil Fertility Experiments in Central Maine

G. L. Terman

Field experiments on potato soil fertility problems were begun in Central Maine in 1947 including a sandy soil at Milo and a Bangor loam soil at Unity. The development and control of potato scab is to be

studied on various plots where the soil is being adjusted to different *p*H levels by liming and the application of an acidifying material such as ammonium sulphate. A comparison also is being made of growing potatoes every year on certain plots in contrast with potatoes in a 2-year rotation with millet and clover.

Extra nitrogen broadcast in addition, to 2100 pounds of 5–10–10 applied in row side bands, slightly increased potato yields at Unity but had no consistent effect at Milo.

Yields of various nonlegume green manure crops grown at Unity were markedly increased by fertilization with ammonium nitrate at rates of 50 and 100 pounds of nitrogen per acre. Millet, field corn, sunflowers, and oats all produced 3 to 4 tons of dry matter per acre when fertilized with nitrogen.

Applying Mulch for Potatoes

G. L. Terman, W. C. Libby, and S. C. Junkins

Light mulching of the land after potatoes are planted, using mulch material grown elsewhere, offers a means of maintaining the soil organic matter so that potatoes can be grown every year on the better, more level land. The mulch crop could be grown on the poorer, more sloping land and applied on the potato land, providing that a feasible means of harvesting and spreading the material can be devised. The need for cultivating the mulched land may be eliminated by chemical control of weeds.

In one test unchopped green gass and green clover mulches, spread at the rates of 5 and 3 tons of dry matter per acre respectively, and applied when the plants were emerging, increased the yield of potatoes slightly. Covering the soil with heavy paper or sawdust, however, decreased the yield 80 to 90 bushels per acre, or a decrease of about 16 per cent. The latter materials apparently reduced the amount of moisture entering the soil from rain, so that the soil on these plots was much drier than on the others at time of harvest.

In a second test partly rotted straw, unchopped green grass and unchopped clover mulches, applied after potatoes had been ridged once by cultivation, all increased the yield appreciably. Sawdust again decreased the yield. Extra nitrogen fertilizer broadcast with the mulch at the rate of 60 pounds N per acre further increased the yield of potatoes mulched with green grass but not of those mulched with green clover. Observations at time of harvest indicated that chopping the materials would be necessary to prevent trouble during digging.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of THE AMERICAN FERTILIZER, published bi-weekly at Philadelphia, Pa., for October 1, 1948

STATE OF PENNSYLVANIA } ss.
COUNTY OF PHILADELPHIA }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared A. A. Ware, who, having been duly sworn according to law, deposes and says that he is the editor of THE AMERICAN FERTILIZER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Name of	Post-office Address
Publisher, Ware Bros. Company,	1900 Chestnut St., Phila., Pa.
Editor, A. A. Ware,	1900 Chestnut St., Phila., Pa.
Managing Editor, None.	
Business Manager, A. A. Ware,	1900 Chestnut St., Phila., Pa.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily, tri-weekly, semi-weekly and weekly publications only.)

A. A. WARE, Editor.

Sworn to and subscribed before me this 21st day of Sept., 1948.

A. F. WALSH,
Notary Public.

(My commission expires March 5, 1949.)

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

AMMONIA—Anhydrous and Liquor
Commercial Solvents Corp., New York City
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM NITRATE
Lion Oil Co., El Dorado, Ark.
Spencer Chemical Co., Kansas Cy, Mo.

BAG MANUFACTURERS—Burlap
Bemis Bros. Bag Co., St. Louis, Mo.
Chase Bag Co., Chicago, Ill.
Fulton Bag & Cotton Mills, Atlanta, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAG MANUFACTURERS—Cotton
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Virginia-Carolina Chemical Corp., Richmond, Va.

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Fulton Bag & Cotton Mills, Atlanta, Ga.
Hammond Bag & Paper Co., Welisburg, W. Va.
International Paper Co., Bagpak Div., New York City
Jaite Company, The, Jaite, Ohio
Raymond Bag Co., Middletown, Ohio
St. Regis Paper Co., New York City

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Huber & Company, New York City
McIver & Son, Alex. M., Charleston, S. C.

BAG CLOSING MACHINES
St. Regis Paper Co., New York City
Union Special Machine Co., Chicago, Ill.

BAG PRINTING MACHINES
Schmutz Mfg. Co., Louisville, Ky.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, The, East Point, Ga.
St. Regis Paper Co., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston, Mass.

BONE BLACK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City

BONE PRODUCTS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
Jackle, Frank R., New York City.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City

BROKERS
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Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
Jackle, Frank R., New York City.
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Schrock Fertilizer Service, Congerville, Ill.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BUCKETS—For Hoists, Cranes, etc.
Hayward Company, The, New York City

BUCKETS—Elevator
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARS AND CARTS
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Stedman's Foundry and Mach. Works, Aurora, Ind

CHEMICALS
American Agricultural Chemical Co., New York City
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Commercial Solvents Corp., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago Ill.
Lion Oil Company, El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Spencer Chemical Co., Kansas City, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Wiley & Company, Baltimore, Md.

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Arkansas Rice Growers Corp. Assn., Stuttgart, Ark
Jackle, Frank R., New York City.
Keim, Samuel D., Philadelphia, Pa.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

CYANAMID
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
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Chemical Construction Corp., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

FERTILIZER (Mixed) MANUFACTURERS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago, I
Southern States Phosphate & Fertilizer Co., Savannah, Ga
Virginia-Carolina Chemical Corp., Richmond, Va.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City.
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FOUNDERS AND MACHINISTS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach Works, Aurora, Ind.

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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
American Agricultural Chemical Co., New York City

LEAD BURNERS
Southern Lead Burning Co., Atlanta, Ga.

LIMESTONE
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

LOADERS—Car and Wagon
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore. Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore. Md.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, The, East Point, Ga.
Hough Co., The Frank G., Libertyville, Ill.
Hayward Company, The, New York City
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, The, East Point, Ga.
Bradley Pulverizer Co., Allentown, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Material Handling
Atlanta Utility Works, The, East Point, Ga.
Hayward Company, The, New York City
Hough Co., The Frank G., Libertyville, Ill.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

MINOR ELEMENTS
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

NITRATE OF SODA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Il
McIver & Son, Alex. M., Charleston, S. C.

NITROGEN SOLUTIONS
Lion Oil Company, El Dorado, Ark.
Spencer Chemical Co., Kansas City, Mo.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J. New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Il
Jackle, Frank R., New York City.
Maryland Drying Mach. Co., Baltimore, Md.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Il
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Southern Lead Burning Co., Atlanta, Ga.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City.

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City
Potash Co. of America, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
United States Potash Co., New York City

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

BUYERS' GUIDE

SCALES—Including Automatic Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

SEPARATORS—Air
Kent Mill Co., Brooklyn, N. Y.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.

SULPHURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicaro, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TAGS
Keener Mfg. Co., Lancaster, Pa.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

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Monarch Mfg. Works, Inc., Philadelphia, Pa.

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Water-Soluble

Double Sulfate of Potash-Magnesia

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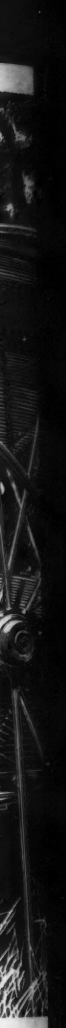

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